



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷: A23L 1/30	A1	(11) International Publication Number: WO 00/64282 (43) International Publication Date: 2 November 2000 (02.11.00)
(21) International Application Number: PCT/IT00/00163 (22) International Filing Date: 27 April 2000 (27.04.00) (30) Priority Data: RM99A000260 27 April 1999 (27.04.99) IT RM99A000646 21 October 1999 (21.10.99) IT (71)(72) Applicants and Inventors: TORTORA, Diomede, Antonio [IT/IT]; Via Acicastello, 32, I-95126 Catania (IT). CORRADINI, Claudio [IT/IT]; Via S. Giovanna Elisabetta, 24, I-00189 Roma (IT). DUGO, Giovanni [IT/IT]; Via Lago di Ganzirri, I-90100 Ganzirri (IT).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> <i>In English translation (filed in Italian).</i>
(54) Title: NUTRACEUTICALS AND INGREDIENTS FOR FUNCTIONAL FOODS (57) Abstract <p>The present invention provides functional food products which can be used as nutraceuticals as well as ingredients for functionalised foods. All the proposed formulations provide nutraceuticals and food products comprising ingredients such as flavonoids, antocyanins, resveratrol, all from natural origin, which are co-spray dried using fructans or fructooligosaccharides instead of maltodextrins as a drying agent. Furthermore, the proposed functional food preparations obtained by spray-dry technique, using fructans of inuline-type, are particularly suitable to form a gel or cream, showing a fat-like texture.</p>		

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NUTRACEUTICALS AND INGREDIENTS FOR FUNCTIONAL FOODS

The main aim of the present invention is to provide nutraceuticals and food products comprising fructans and fructooligosaccharides (FOS) and nutraceutical ingredients
5 such as flavonoids, antocyanins, resveratrol; all from natural origin.

Fructans and fructooligosaccharides (FOS) are naturally occurring storage carbohydrates present in numerous plant. They are defined as polydisperse either linear or branched chain carbohydrates with a degree of polymerisation (DP) ranging from 3 to 60. The low-molecular weight fractions (DP 3 to 20) are commonly known as FOS or oligofructose.

10 Their molecular major structure GFn (where G = glucose, F = fructose, n = number of monosaccharides) is represented by n D-fructofuranosyl units (Fn) linked by $\beta(2 \rightarrow 1)$ bonds. Fructans and fructooligosaccharides are nondigestible carbohydrates of the non-glucan type which, because of the configuration of their osidic bonds $\beta(2 \rightarrow 1)$, resist hydrolysis by salivary and intestinal digestive enzymes. On the basis of their
15 nondigestibility, they can be considered in the same way as dietary fiber components.

In food science the interest in dietary fibers has been increasing because of its potential health implications. The term "fiber" refers generally to the bulky part of food that can not be broken down by enzymes in the small intestine, consisting of cellulose, pectine and other materials. The important physiological effects of fiber are related to this
20 characteristics, as well as to water and ion-binding capacity, viscosity and the products of their fermentation in bowel. The implication is that fiber increases bulk, dilutes colonic contents, speed transit time and changes bacterial metabolism, possibly providing protection from some diseases of the gut. Dietary fiber can alter lipid metabolism by interfering with cholesterol absorption, changing lipoprotein lipase activity or fatty acid

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metabolism. Furthermore, dietary fiber has been seen to lower blood glucose levels and influence carbohydrate metabolism. It is well known that a diet high in fiber is beneficial for a variety of reasons. Dietary fiber aids digestion because it provides an indigestible biomass which is carried through the alimentary canal causing undigested food to be pushed out before it. Dietary fiber also clears out bacteria and insures the proper working of the peristaltic muscle. A diet high in fiber has been shown to reduce serum cholesterol and triglyceride levels and has been linked to lower rates of intestinal and colon cancer. Fructans and fructooligosaccharides can be defined as a soluble fiber and are commonly used as a source of fiber. They are also typical "prebiotics". Besides their bifidogenic effect, fructans and fructooligosaccharides have additional nutrition properties on digestive physiological parameters like colonic pH and stool bulking which justify their classification as dietary fibers.

The aim of the present invention is to provide functional food preparations that can be used as ingredient in food compositions or as nutraceuticals which contain fructans (and/or fructooligosaccharides) and phytochemicals (plant polyphenols), such as flavonoids (hesperidin, naringin and hesperetin), anthocyanins (particularly cyanidin-3-glucoside) and resveratrol (trans-3,4',5-trihydroxystilbene).

Flavonoids are a class of naturally occurring and structurally related compounds found widely distributed in plant and plant food. Although flavonoids are considered to be non-nutrition agents, there is an increasing interest in these substances because of possible effects on human health. Flavonoids have a variety of biological effects, such as antioxidants, antiviral, anti-allergic and anti-carcinogenic effects. There is convincing epidemiologic evidence that consumption of fruit and vegetable containing flavonoids contribute to the prevention of degenerative processes, particularly lowering incidence

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and mortality rate of cancer and cardio- and cerebrovascular diseases. These compounds may act as antioxidant or as agents of other mechanisms contributing to an anticarcinogenic or cardioprotective action. All citrus fruits are characterised by substantial accumulation of flavonoids whose utilisation is of increasing interest. Hesperidin, the most abundant
5 flavanone glucoside of orange peel, is known to increase capillary resistance in various conditions.

Anthocyanins belong to the flavonoid-type of phenolic molecules. Similarly as the other flavonoids, anthocyanins have been shown to have some positive therapeutic effects, including the maintaining normal vascular permeability and fragility, preventing
10 cholesterol induced arteriosclerosis. They are the most important group of water soluble plant pigments visible to the human eye and they are largely responsible for the colours of flower petals and fruits. Particularly, the presence of anthocyanins is typical of blood orange varieties (Sanguinello, Moro and Tarocco varieties).

Resveratrol is one of the phenolic compounds present in wine (mainly in red wine), that
15 could be responsible for the decrease in coronary heart disease observed among wine drinkers. This potential effect could be due to the ability of resveratrol to inhibit low-density lipoproteins (LDL) oxidation. The cis isomer of resveratrol has anticancer activity, as do the trans isomers by inhibiting protein-tyrosine kinase and cis-resveratrol also shows anti-aggregation properties.

20 The purpose of this invention is to provide functional food preparation combining the beneficial effects of fructans and/or fructooligosaccharides and biophenols (the above-mentioned flavonoids, anthocyanins, resveratrol).

Another aim of the present invention is to provide preparations which are easy to use as food supplements, mixed in various foodstuff or drinks. Thus, the preparations of the

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invention are characterised by being a mixture of components which are co-spray dried using fructans or fructooligosaccharides instead of maltodextrin as a drying agent.

Furthermore, functional food preparation obtained by spray-dry technique, using fructans of inuline-type, are particularly suitable to form a gel or creme, showing a fat-like texture.

5 Another aim of the present invention is to provide functional food products which can be prepared using the above mentioned ingredients adding one or more metals such as calcium, magnesium, iron, selenium. Furthermore, the same functional food products can be added with beta-glucans, which combining the beneficial effects of the above-mentioned ingredients.

10 Typical functional food product of the present invention will become apparent in the description that follows:

Fructans and or fructooligosaccharides from 10 to 90%, polyphenols (naringine, hesperidine, hesperetine, cyanidins, trans-resveratrol) from 0.1 to 80%.

Can be used as fructans commercial products of the inulin type extracted from chicory ,
15 as well as fructooligosaccharide which is produced enzymatically from beetsugar and consists mainly of GF2, GF3 and GF4. (for instance, actilight of Beghin-Meiji Industries, Neully sur Seine, Cedex, France). All functional food products are based mainly on fruit and vegetal ingredients and are obtained using fructans and/or fructooligosaccharides as a carrier employing spray-drying technology. For instance a
20 granular concentrated of a citrus extract (bergamot, bitter orange or blood orange varieties) wherein inulin from chicory is used as a carrier for citrus extract which are co-spray dried without the use of maltodextrin as a drying agent. It is obvious to those skilled in the art that the embodiments of the invention are not confined to the examples given above, but may vary within the scope of the accompanying claims.

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What is claimed is:

- 1-Functional food product composition comprising A. Linear fructans, branched fructans and/or fructooligosaccharides from 10 to 90% by weight on the dry matter of said ingredient; B, polyphenols (naringine, hesperidine, hesperetin, anthocyanins, resveratrol) from 0.1 to 80% by weight on the dry matter of said ingredients.
- 2- functional food product according to the claim 1, which contains fructans, either of the inuline type, or fructooligosaccharides and flavonoids (naringine, hesperitin, hesperedin, anthocyanins and resveratrol) in all possible combinations.
- 3- functional food product according to the claim 1, where the flavonoid is naringine.
- 4- functional food product according to the claim 1, where the flavonoid is hesperetin.
- 5- functional food product according to the claim 1, where the flavonoid is hesperidin
- 6- functional food product according to the claim 1, where the flavonoid is the anthocyanins cyanidins-3glucoside
- 7- functional food product according to the claim 1, which contains hesperidin, hesperetin, naringine, and cyanidins-3glucoside
- 8- functional food product according to the claim 1, which contains resveratrol (trans-3, 4', 5,-trihydroxystilbene.
- 9- functional food product according to the claim 1 which contains calcium (as lactate, gluconate, as ascorbate), from 0,5 to 25% by weight on dry matter of said ingredient
- 10- functional food product according to any of the claims 1 to 9 characterised in that the drying consists of spray-dry tecnology.
- 11- functional food product according to any of the claims 1 to 10 characterised in that it contains calcium obtained from vegetal extracts at the minimum level greater them 10%

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by weight on dry matter of the said ingredient.

12- functional food product according to any of the claims 1 to 11 characterised in that it contains in that it contains vitamin D3.

13- functional food product according to any of the claims 1 to 12 which contains
5 calcium and magnesium compounds at the minimum level greater than 01% by weight on dry matter of the said ingredient.

14- functional food product according to any of the claims 1 to 13 which contains iron compounds at the minimum level greater than 0,1% by weight on dry matter of the said ingredient.

10 15- functional food product according to any of the claims 14 which contains selenium at the minimum level greater than 0,1% by weight on dry matter of the said ingredient.

16- functional food product according to any of the claims 1 to 15 which contains beta-glucans, which are co-spry dried from 0,5% to 50% by weight on dry matter of the said ingredient.

15 17- functional food product according to any of the claims 1 to 16 characterised in that it is addet characterised.

18 – Functional food product according to to any of the claims 1 to 17, which is co-spray dried either with a bilberry juice or with a bilberry extract.

INTERNATIONAL SEARCH REPORT

Inter national Application No
PCT/IT 00/00163

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A23L1/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, FSTA, WPI Data, PAJ, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

24 August 2000

Date of mailing of the international search report

04/09/2000

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